Space Weather Technical Forecast

Issued on Thursday 20 February 2025 at 00:14 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C8.1 at 19/2345 UTC from ex-AR3991 in the southwest. There are seven sunspot regions on the Earth-facing disc, however these are all small and simple, with the most notable AR3998 and AR3996 in the southeast. However have both been inactive, with little growth or magnetic complexity.

No Earth-directed CMEs have been observed. However, a filament disruption was observed in the south-centre disc around 19/1900 UTC with imagery not yet available to assess if any CME was produced.

Solar Wind / Geomagnetic Activity: Solar winds showed the tail end of coronal hole 15, with an additional enhancement from one or more weak CME glances, perhaps arriving around 19/0030 UTC, but also possible before this period. Solar winds, as measured by ACE and DSCOVER at L1 were slightly elevated at 450km/s at first, then gradually rose to be elevated at near 550km/s by 19/0200 UTC, before erratically easing to be slightly elevated at 450-500km/s from 19/0900 UTC. Density was variable at ACE through the morning, but otherwise mainly at or below average. Interplanetary Magnetic Field, Bt, was Weak to Moderate, peaking 10nT, but with a gradual easing trend, to be mainly Weak 5-7nT from 19/1030UTC. The north-south component rotated from mainly negative (southward) until 19/0800 UTC, with minimum -9nT, to be mainly positive (northward) until 15/1540 UTC with peak +8nT, to then be mainly negative again thereafter, with minimum -8nT. Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet to Active (Kp1-4), but with one G1 Minor Storm interval (Kp5) 19/0000-0300 UTC.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 persisted at Background. High energy electron flux (greater than 2MeV) at GOES16 was Moderate, peaking at 520pfu at 18/0200UTC. The associated 24-hour fluence was below the Active threshold (1e8 integrated pfu), with the 20/0000UTC observation being 1.23e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be generally Low, with a chance of isolated M-class flares.

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Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, although this may change based upon assessments of the filament disruption centre disc at 19/1900 UTC once imagery is available. Otherwise, current fast wind influence from CH15/-, which is no longer visible, should soon ease with slightly elevated solar winds gradually easing towards background. Geomagnetic activity is forecast to be Quiet with Unsettled intervals and a slight chance of Active intervals at first.

Energetic Particles / Solar Radiation: High energy proton flux is expected to persist at background. High energy flux is expected to be mainly Moderate, with a slight chance of rising to High at first, but with an overall declining trend towards background. The associated 24 hour fluence is expected to remain below Active.

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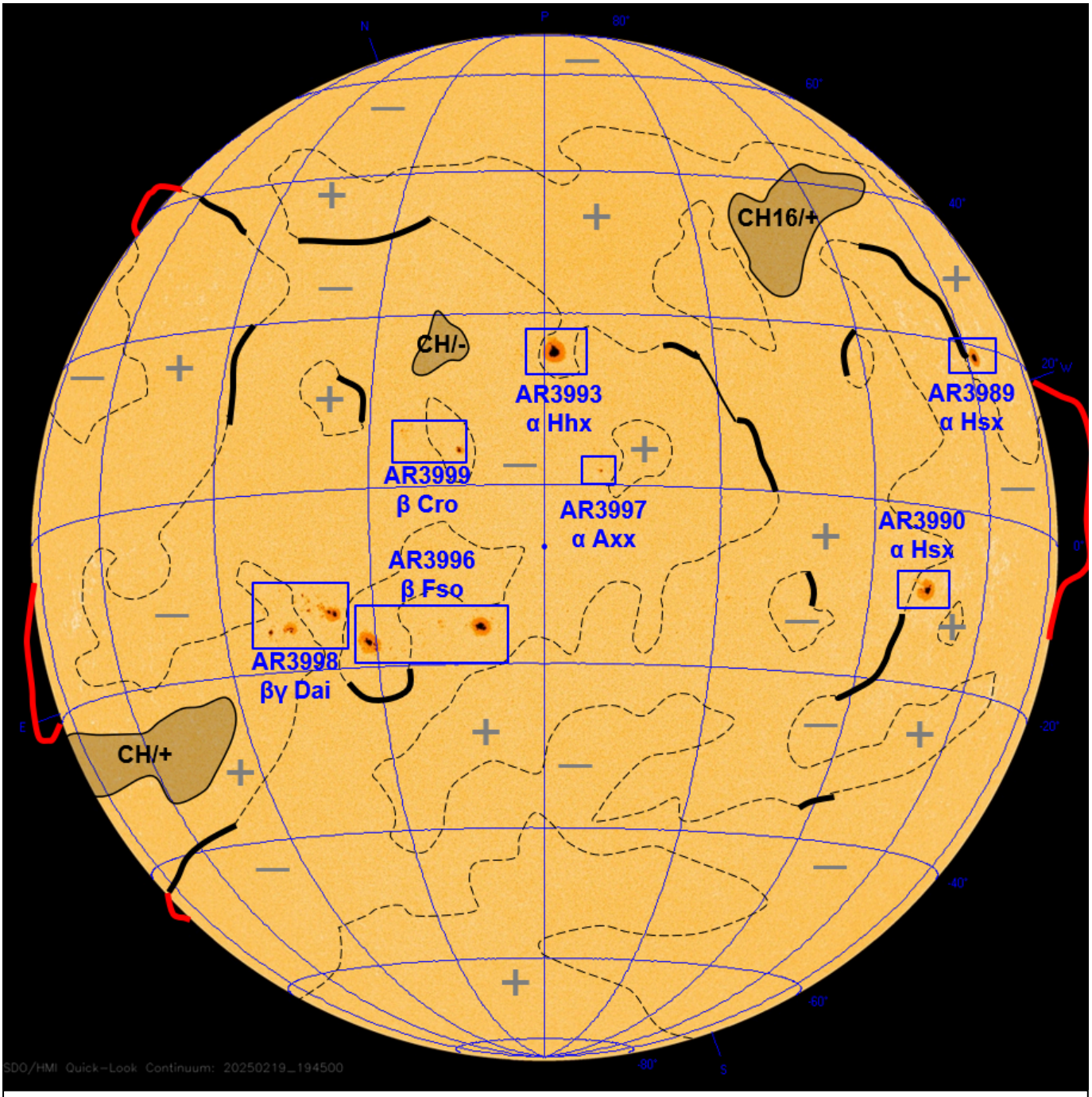
Figure 1: MOSWOC Solar Synoptic Map 19/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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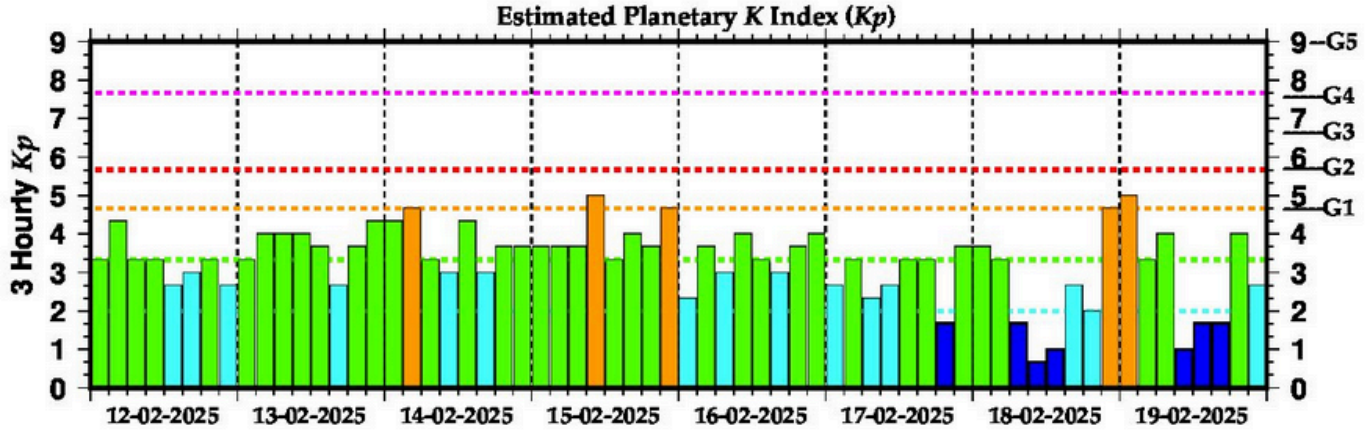
Geomagnetic Storms

There are no Earth-directed CMEs, however a filament disruption was observed in the centre disc around 19/1900 UTC. Imagery is still be assessed to determine if a CME was released.

Solar winds are currently slightly elevated, after the recent enhancement from CH15/-, which is no longer visible on the Earth-facing disc, and the glancing CMEs. No further enhancements are expected with a gradual easing trend expected for the solar wind, perhaps falling to background by the end of the period. Geomagnetic activity is forecast to be mainly Quiet with isolated Unsettled intervals, and a slight chance of Active intervals, mainly early in the period.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	5	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: BGS Estimated Kp, showing G1 19/0000-0300. G1 18/2100-0000 was reported as Kp4 (Active) by Potsdam.



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Radio Blackouts - X-Ray Flares

Low solar activity is forecast with a chance of rising to Moderate with isolated M-class flares possible.

There are seven sunspot regions on the visible disc, however all of these are relatively small and simple, with very little growth or development observed. The most notable regions are perhaps AR3998 and AR3996 in the southeast. The former has some ongoing motion of its spots, however this appears to be due to this maturing into a mostly simple bipolar configuration. While the later, remains a longitudinally wide spot with its previous intermediate spots having faded and little sign of any further growth. The other regions remain small and inactive.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	No	40	40	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 3: GOES-16/18 X-ray Irradiance

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Solar Radiation Storms (High Energy Protons)

GOES18 high energy proton flux is most likely to persist at background levels. The sunspot regions currently on the disc unlikely to produce flares that would result in the release of Earth-directed high energy protons.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	2	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

High energy electron flux, as observed at GOES-16 is now at persistently Moderate, after the recent glancing CME enhancement on 18-19 Feb likely resulted in a drop out of the charge through the Van Allen Belt. As solar winds ease, the observed flux at GEO may rise still rise a little, with a chance of reaching a diurnal high peak 20-21 Feb (Day 1-2) , however this is expected to only be short-lived, with a declining trend more likely, especially day 3-4 (21-22 Feb).

The associated 24 hour fluence is currently below the Active level, and expected to persist below this level, with a likely declining trend, particularly by day 3-4 (22-23 Feb).

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

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Figure 4: GOES-16 Electron Flux and associated 24hr Fluence for the last 3 days, with REFM and recurrence.

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